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EXAMINER	
HUGHES, SCOTT A	

ART UNIT	PAPER NUMBER
3663	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/604,878	ESMERSOY ET AL.
	Examiner	Art Unit
	SCOTT A. HUGHES	3663

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 December 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *36-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *36-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8/24/09, 12/03/09*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 8/31/2009 have been fully considered but they are not persuasive.

Applicant argues that the previous rejection used hindsight to combine the references to meet applicant's claim limitations. Applicant argues that none of the cited references would provide suggestion or motivation to combine the references, and applicant argues that such motivation must come from the prior art. These arguments are not persuasive, as the motivations for combining the references come from the teachings in the cited references.

As noted by applicant, the Examiner conceded that Kan fails to disclose that a plurality of surface located sources and a plurality of surface located receivers are used to obtain the claimed surface seismic data, and thus cites Ireson to teach this. Applicant argues that neither Kan nor Ireson contain a teaching or suggestion which would motivate a person of ordinary skill in the art to combine Kan and Ireson to arrive at the claim limitations. This argument is not persuasive, as the cited portions of Kan teach a plurality of surface locations for both sources and receivers used to obtain surface data, but simply do not disclose the specifics of the equipment that would be used to obtain data at these plurality of source and receiver locations. Therefore, one or ordinary skill in the art would look to teachings of how surface seismic surveys are acquired in order to determine what equipment to use to obtain surface seismic data at the plurality of surface source and receiver locations that are part of the process in Kan.

Ireson is directed to surface seismic surveys, and therefore one of ordinary skill in art would be motivated to look to Ireson to determine what equipment could be used to obtain the data at the plurality of surface source and receiver locations required in Kan.

Applicant notes that Examiner concedes that Kan fails to disclose that velocity is determined by inversion of surface seismic data, and thus cites Stewart. Applicant argues that there is no teaching or suggestion in Kan or Stewart which would motivate a person of ordinary skill in the art to combine the references to arrive at the claim limitations. Applicant further argues that because Kan discloses an inversion method for determining velocity of VSP data but fails to disclose using inversion to determine velocity of the surface seismic data is indicative of the fact that Kan teaches away from the present invention. These arguments are not persuasive, as Kan provides both the motivation to look to methods of determining velocity for surface seismic data and further does not teach away from using an inversion method to do this. Kan teaches that the velocity of surface seismic data is used in the method, but simply does not disclose that the method of determining the velocity from this surface data includes an inversion procedure. Kan teaches one way to determine velocity from the surface seismic data, but has not provided all of the specifics of doing this and has further not stated that the picking procedure is the only procedure for determining velocity from the surface seismic data. As Kan is teaching determining velocity from surface seismic data, one of ordinary skill in the art would be aware of the different methods used to determine velocity from surface seismic data, and would be motivated to use these different methods that are known to provide accurate velocity determinations. Further,

by teaching that inversion is a procedure that can be used to determine velocity from VSP data, Kan has provided a motivation to use this similar procedure to determine the velocity from the surface data as Kan has acknowledged that inversion works for determining velocity of subsurface formations. As Kan has disclosed both determining velocity from surface data and also determining velocity through inversion procedures, one of ordinary skill in the art would have a reasonable expectation of success that using inversion would also provide velocities from the surface seismic data. Stewart provides the teaching that inversion can be used with both VSP and surface seismic data to determine velocity. As these are the two types of data being used in Kan, one of ordinary skill in the art would be motivated by the teachings in Stewart to use the same inversion procedure to determine the velocity from both the VSP and surface seismic data in Kan in order to use a consistent procedure. Further, as Stewart acknowledges that inversion can be used on the two types of data present in Kan, there is a reasonable expectation of success that inversion would work for both the VSP and surface data in Kan.

Applicant’s arguments are not persuasive, as Kan is directed to surface seismic data using a plurality of source and receiver locations (Fig. 7a), therefore providing a motivation to look to references which teach the equipment that could be used to obtain this type of data. Kan discloses determining velocity from VSP and surface seismic data, and using these determined velocities. Therefore, there would be a motivation to look to known velocity determination methods, including inversion processes, to arrive at the velocities used in the process disclosed in Kan.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 36-39, 41, 44-46, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Ireson (6201765) and Stewart (ASEG/SEG Conference – Adalaide, 1988).

With regard to claim 36, Kan discloses a method of estimating velocity ahead of a drill bit disposed in a subsurface region (Column 8, Line 40 to Column 9, Line 10). Kan discloses obtaining surface seismic data for a region of interest (Column 6, Lines 20-37; Column 8, Lines 40-57). Kan discloses during drilling of a borehole traversing the subsurface region, determining a travel time of a seismic wave generated from a surface of the region to a location in the borehole when the drill bit is at selected depths in the borehole (Column 7, Line 66 to Column 8, Line 57). Kan discloses determining a velocity from the travel time and the selected depths (Column 8, Lines 1-57). Kan discloses inverting reflection seismic data (data reflected from structures below drillbit and received in the borehole receivers), although not specifically the surface seismic data, to determine a velocity ahead of the drill bit while constraining the velocity between the surface and the drill bit to be consistent with the velocity determined from

the travel time (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3). Kan discloses that the VSP data is used to replace interval transit times from the surface seismic data with the velocity determined from the VSP checkshot survey to the depths of the borehole that the VSP data was taken. Replacing the velocity constrains it to being the velocity determined from the transit times of the VSP survey in the borehole.

Kan discloses surface seismic data and discloses a plurality of surface located source and receiver locations used to take the surface seismic data as common midpoint data (Column 6) (Fig. 7a), but does not specifically disclose that a plurality of surface located sources and a plurality of surface located receivers are used to obtain the surface seismic data. Ireson teaches that it is known that surface seismic data are obtained using a plurality of surface sources and a plurality of surface receivers are used in obtaining surface seismic data (Fig. 1) (Column 1, Lines 9-40). It would have been obvious to use a plurality of sources and receivers to obtain the surface seismic data in Kan as taught by Ireson in order to obtain common midpoint data about an origin or midpoint.

Although Kan does not teach inverting the surface seismic data, Kan does disclose finding the velocities above the drill bit with the VSP, and then using this data in the process of finding interval velocities ahead of the bit by inversion methods for seismic data that has been reflected from structures ahead of the bit and received at receivers in the wellbore (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3). Kan teaches that the velocity determined from the surface seismic data is constrained by the velocity determined from the travel times and depths of the waves

from the surface to the borehole location (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3), but does not specifically disclose that the velocity determined from the surface seismic data is determined by an inversion of the surface seismic data. Stewart teaches that inversion methods are used on both VSP and surface seismic data when determined velocity structures of underground formations (Page 358, Summary; Page 359, Second Column to Page 360 Second Column). It would have been obvious to use an inversion process on the surface seismic data in Kan to determine the velocity structure as taught by Stewart in order to determine the velocity structure of the subsurface in depth.

With regard to claim 37, Kan discloses transforming the velocity ahead of the drill bit into pore pressure of a region ahead of the drill bit (Column 6, Line 20 to Column 7, Line 21; Column 8, Lines 5-57).

With regard to claim 38, Kan discloses that the seismic wave is generated by a seismic source positioned near an opening of the borehole (Column 8, Lines 1-18).

With regard to claim 39, Kan discloses that determining the travel time of the seismic wave comprises detecting the seismic wave from at least one seismic receiver at location in the borehole (Column 8).

With regard to claim 41, Kan discloses that determining the travel time further comprises measuring the arrival time of the seismic wave detected at the seismic receiver and determining the travel time from the arrival time (Column 8, Lines 10-57).

With regard to claim 44, Kan discloses a method of estimating velocity ahead of a drill bit disposed in a subsurface region (Column 8, Line 40 to Column 9, Line 10).

Kan discloses generating first seismic waves from a seismic source S located at a surface of the region (Fig. 7a) (Column 6, Lines 20-37; Column 8, Lines 40-57). Kan discloses obtaining surface seismic data associated with the first seismic waves at a plurality of locations R at the surface (Fig. 7a) (Column 6, Lines 20-37; Column 8, Lines 40-57). Kan discloses generating second seismic waves from the surface when the drill bit is disposed in a borehole (Column 8, Lines 1-57). Kan discloses obtaining seismic wave data associated with the second waves at one or more locations in the borehole (Column 8, Lines 1-57). Kan discloses inverting the obtained seismic wave data with reflection seismic data (data reflected from structures below drillbit and received in the borehole receivers) obtained for the region to determine a velocity ahead of the drill bit (Column 8, Line 40 to Column 9, line 3). Kan discloses inverting the obtained seismic wave data, but does not specifically disclose that the obtained surface seismic data is also inverted in the determination of the velocity.

Kan discloses surface seismic data and discloses a plurality of surface located source and receiver locations used to take the surface seismic data as common midpoint data (Column 6) (Fig. 7a), but does not specifically disclose that a plurality of surface located sources and a plurality of surface located receivers are used to obtain the surface seismic data. Ireson teaches that it is known that surface seismic data are obtained using a plurality of surface sources and a plurality of surface receivers are used in obtaining surface seismic data (Fig. 1) (Column 1, Lines 9-40). It would have been obvious to use a plurality of sources and receivers to obtain the surface seismic

data in Kan as taught by Ireson in order to obtain common midpoint data about an origin or midpoint.

Although Kan does not teach inverting the surface seismic data, Kan does disclose finding the velocities above the drill bit with the VSP, and then using this data in the process of finding interval velocities ahead of the bit by inversion methods for seismic data that has been reflected from structures ahead of the bit and received at receivers in the wellbore (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3). Stewart teaches that inversion methods are used on both VSP and surface seismic data when determined velocity structures of underground formations (Page 358, Summary; Page 359, Second Column to Page 360 Second Column). It would have been obvious to use an inversion process on the surface seismic data in Kan as well as the VSP and checkshot data to determine the velocity structure as taught by Stewart in order to determine the velocity structure of the subsurface in depth.

With regard to claim 45, Kan discloses transforming the velocity ahead of the drill bit into pore pressure of a region ahead of the drill bit (Column 6, Line 20 to Column 7, Line 21; Column 8, Lines 5-57).

With regard to claim 46, Kan discloses that the surface seismic data is obtained for the subsurface region before the borehole is formed in the region (Column 6; Column 8, Lines 40-57).

With regard to claim 54, Kan discloses that the surface seismic data is obtained before commencement of drilling of the borehole (Column 6; Column 8, Lines 40-57).

Claims 40 and 42-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Ireson (6201765) and Stewart (ASEG/SEG Conference – Adalaide, 1988) as applied to claims 36-39 and 41 above, and further in view of Eaton (6382332).

With regard to claim 40, Kan does not disclose that the seismic receiver is disposed in a downhole tool near the drill bit. Kan discloses using the receiver during drilling, but does not disclose the location of the receivers used. Eaton teaches a method of determining time-depth check-shots and also obtaining VSP data using a downhole tool 14 that is located near the drill bit 13 (Fig. 1) (abstract; Column 2). It would have been obvious to modify Kan to include using a tool located near the drill bit for the receiver in the borehole in order to be able to take data without requiring that the drillstring be removed or that further devices are placed into the borehole.

With regard to claim 42, Kan does not disclose that measuring the arrival time comprises sending the seismic wave detected in the borehole to the surface and processing the detected seismic waves at the surface to determine arrival time. Kan does not disclose where the processing is performed. Eaton teaches that data obtained in receivers in a borehole can be sent to the surface for processing (Column 6, Lines 18-46). It would have been obvious to modify Kan to include sending the data to the surface to be processed as taught by Eaton in order to have a central processing unit at the surface that can perform all of the necessary data processing and also control the survey apparatus.

With regard to claim 43, Kan does not disclose that measuring the arrival time comprises processing the seismic wave detected in the borehole to determine the

arrival time and sending the arrival time to the surface via telemetry. Kan does not disclose where the processing is performed. Eaton teaches that the data received in a borehole receiver can be processed in the receiver (Column 5, Lines 55-65; Column 6). It would have been obvious to modify Kan to include performing the processing in the borehole and sending the time to the surface via telemetry as taught by Eaton in order to reduce the data rate to a level commensurate with the link to the surface and to limit the amount of data that needs to be transmitted to the surface.

Claims 47-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Ireson (6201765) and Stewart (ASEG/SEG Conference – Adalaide, 1988) as applied to claims 44-46 above, and further in view of Leaney.

With regard to claim 47, Kan does not disclose that the surface seismic data is obtained for the subsurface region after the borehole is formed in the region. Leaney teaches taking VSP surveys in a borehole and then using the surveys to create models that are used to process surface seismic data (abstract; Column 3, Line 55 to Column 4, Line 68). It would have been obvious to modify Kan to include taking VSP survey data, and then acquiring surface seismic data and processing the surface seismic data as taught by Leaney in order to have a model of the velocity created from the VSP data that can be used to process surface seismic data that is taken in a region.

With regard to claim 48, Kan does not disclose that the surface seismic data is obtained for the subsurface region during drilling of the borehole is formed in the region. Leaney shows acquiring VSP and surface seismic data at the same time (Fig. 1)

(abstract; Column 3, Line 55 to Column 4, Line 68). It would have been obvious to modify Kan to include taking both the data with the borehole receivers and the surface seismic data receivers at the same time as taught by Leaney in order to obtain a model from the VSP that is accurate for the formation at the time the surface seismic data are obtained.

Claims 49-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Stewart (ASEG/SEG Conference – Adalaide, 1988)

With regard to claim 49, Kan discloses a method of estimating velocity ahead of a drill bit disposed in a subsurface region (Column 8, Line 40 to Column 9, Line 10). Kan discloses generating first seismic waves from a plurality of first locations at a surface of the region (Fig. 7a) (Column 6, Lines 20-37; Column 8, Lines 40-57) before the drill bit is drilling subsurface formations in a borehole traversing the subsurface (Column 6; Column 8, Lines 40-57). Kan discloses obtaining first seismic data associated with the first seismic waves at a plurality of second locations R at the surface of the region (Fig. 7a) (Column 6, Lines 20-37; Column 8, Lines 40-57) before the drill bit is drilling the subsurface formations in the borehole (Column 6; Column 8, Lines 40-57). Kan discloses generating second seismic waves from the surface of the region when the drill bit is drilling subsurface formations in the borehole (Column 8, Lines 1-57). Kan discloses obtaining seismic wave data associated with the second seismic waves at one or more locations in the borehole during drilling (Column 8, Lines 1-57). Kan discloses inverting the obtained second seismic wave data with reflection seismic

data (data reflected from structures below drillbit and received in the borehole receivers) obtained for the region to determine a velocity ahead of the drill bit (Column 8, Line 40 to Column 9, line 3). Kan discloses inverting the obtained second seismic wave data, but does not specifically disclose that the obtained surface seismic data is also inverted in the determination of the velocity.

Although Kan does not teach inverting the surface seismic data, Kan does disclose finding the velocities above the drill bit with the VSP, and then using this data in the process of finding interval velocities ahead of the bit by inversion methods for seismic data that has been reflected from structures ahead of the bit and received at receivers in the wellbore (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3). Stewart teaches that inversion methods are used on both VSP and surface seismic data when determined velocity structures of underground formations (Page 358, Summary; Page 359, Second Column to Page 360 Second Column). It would have been obvious to use an inversion process on the surface seismic data in Kan as well as the VSP and checkshot data to determine the velocity structure as taught by Stewart in order to determine the velocity structure of the subsurface in depth.

With regard to claim 50, Kan discloses transforming the velocity ahead of the drill bit into pore pressure of a region ahead of the drill bit (Column 6, Line 20 to Column 7, Line 21; Column 8, Lines 5-57).

With regard to claim 51, Kan discloses that the step of generating seismic waves is performed according to a predetermined sequence (different depths) and the

obtained seismic wave information is performed corresponding to the predetermined sequence (Column 8, Line 1 to Column 9, Line 10).

Claims 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Stewart (ASEG/SEG Conference – Adalaide, 1988) as applied to claims 49-51, and further in view of Eaton (6382332).

With regard to claim 52, Kan discloses determining seismic travel times from a position of the generating seismic waves to the one or more locations in the borehole (Column 7, Line 66 to Column 8, Line 57). Kan does not disclose that a processor in the borehole does in the determining. Kan does not disclose where the processing is performed. Eaton teaches that the data received in a borehole receiver can be processed in the receiver (Column 5, Lines 55-65; Column 6). It would have been obvious to modify Kan to include performing the processing in the borehole and sending the time to the surface via telemetry as taught by Eaton in order to reduce the data rate to a level commensurate with the link to the surface and to limit the amount of data that needs to be transmitted to the surface.

With regard to claim 53, Kan discloses determining seismic travel times from a position of the generating seismic waves to the one or more locations in the borehole (Column 7, Line 66 to Column 8, Line 57). Kan does not disclose where the determining is performed. Eaton teaches that data obtained in receivers in a borehole can be sent to the surface for processing (Column 6, Lines 18-46). It would have been obvious to modify Kan to include sending the data to the surface to be processed as

taught by Eaton in order to have a central processing unit at the surface that can perform all of the necessary data processing and also control the survey apparatus.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SCOTT A. HUGHES whose telephone number is (571)272-6983. The examiner can normally be reached on M-F 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack Keith can be reached on (571) 272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Scott A. Hughes/
Examiner, Art Unit 3663